

**SYSTEM AND METHOD FOR  
GENERATING WORLD WIDE NAMES**

Inventor:

Ahmad H. Tawil  
1503 Laurel Oak Loop  
Round Rock, Texas 78664

Jacob (NMI) Cherian  
12345 Lamplight Village Avenue, #1524  
Austin, Texas 78758

Assignee:

DELL PRODUCTS L.P.  
One Dell Way  
Round Rock, Texas 78682-2244

BAKER BOTTS L.L.P.  
One Shell Plaza  
910 Louisiana  
Houston, Texas 77002-4995

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**SYSTEM AND METHOD FOR  
GENERATING WORLD WIDE NAMES**

TECHNICAL FIELD

This invention relates in general to the field of network addressing, and more particularly to a system and method for generating world wide names.

BACKGROUND

Demand for data storage capacity has increased substantially as the use of data intensive applications has grown more common. Internet use and data-intensive applications such as multimedia and online transaction processes have contributed to the increased demand for data storage capacity. Users are also demanding faster access to the data and the ability to share pooled data among a large number of users over distributed locations.

To meet demands for increased storage capacity and more rapid access to data, the computer industry is turning to storage area networks (SANs), collections of data storage devices interfaced with one or more servers or workstations. Many SANs make use of Fibre Channel (FC) technology for transmitting data at higher rates. FC devices are often based on Fibre Channel Protocol (FCP) which may also be referred to as the Fibre Channel standard. FCP supports a number of protocols including SCSI, Asynchronous Transfer Mode, Transmission Control Protocol/Internet Protocol (TCP/IP), High Performance Parallel Interface (HiPPI), Intelligent Peripheral Interface (IPI) and others.

FCP requires that each node and its associated ports in a Fibre Channel network have unique addresses known as Worldwide Names. Each Worldwide Name contains eight bytes (64 bits). Three bytes (twenty-four bits) are used to identify the manufacturer of the device and are assigned to registered members by the Institute of Electrical and Electronics Engineers (IEEE). Another

three bytes define the vendor specified field and are used by each vendor to create a unique identifier for the devices. The remaining two bytes may also be used by the manufacturer to extend the vendor specified field.

- 5           Although each Worldwide Name contains eight bytes of information, manufacturers may only the vendor specified field to define unique addresses for their devices. Once the manufacturer exhausts all of the possible combinations in the vendor specified field, the
- 10   manufacturer must be assigned a new company identification number by the IEEE. Manufacturers are required to manage their assignment of identification numbers to insure that duplicate addresses are not assigned. Because FCP allows for a longer address field,
- 15   existing systems used to manage the assignment of identifiers for MAC addresses will not allow for the management of assigned identifiers for FCP devices. Consequently, managing the identifiers of FC devices typically requires establishing an additional system to
- 20   keep track of the assignment of identifiers for those devices.

- Another difficulty associated with the assignment of WWNs is that if a manufacturer switches from assigning MAC addresses to WWNs, the manufacturing process requires
- 25   modification to incorporate the WWN since the worldwide name is typically stored in non-volatile memory such that the WWN is saved when a system is turned off or power is lost.

Another difficulty with assigning WWNs to fibre channel devices is the need to include additional non-volatile random access memory (NVRAM) on either the device itself or the motherboard of a server that the  
5 device couples to. Because NVRAM is typically expensive, the need for additional NVRAM for storage WWNs increases the overall cost of the system.

SUMMARY

Therefore, a need has arisen for method of assigning world wide names that minimizes the need for NVRAM.

A further need has arisen for a system and method of  
5 assigning WWNs that facilitates the management of identifiers to insure that duplicate identifiers are not assigned for generating worldwide names for fibre channel devices.

In accordance with the present disclosure, a method  
10 and system is provided that substantially eliminates or reduces disadvantages and problems associated with previously used methods for generating worldwide names. The method and system includes reading a media access control (MAC) address associated with a network interface  
15 card (NIC). The method and system then generates a worldwide name for a fibre channel device by appending a vendor specific identifier assigned to the fibre channel device to the MAC address obtained from the network interface card.

20 More specifically, an application module associated with a server operable to interface with a fibre channel network reads a MAC address of the NIC associated with the server. After reading the MAC address, the application module identifies target devices interfaced  
25 with the server. The application module then generates a unique vendor specified identifier to each of the identified target devices. The application module generates a worldwide name for each target device by appending the unique vendor specified identifier

generated for each respective target to the MAC address read from the NIC.

In one embodiment, the MAC address for the NIC includes a company identification field and a first vendor field that has a first vendor specified identifier. The worldwide name for each of the identified target devices includes the MAC address, a second vendor field that has a second vendor specified identifier and a network address authority (NAA) field. The application module assigns the second vendor specified identifier to each of the target devices to generate the unique worldwide name for each target device.

The present disclosure provides a number of important technical advantages. One such advantage is providing an applications module to generate WWN's for identified target devices. The use of the application module eliminates the need to store the WWNs of the identified devices in NVRAM.

Another technical advantage of the present disclosure is appending an existing MAC address of the NIC to generate a WWN. This reduces the need for manufacturers to maintain and manage vendor specified identifiers for PC devices separately from MAC addresses.

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BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present embodiments and advantages thereof may be acquired by referring to the following description taken in  
5 conjunction with the accompanying drawings, in which like reference numbers indicate like features, and wherein:

FIGURE 1 illustrates a block diagram of a storage area network;

FIGURE 2 illustrates a block diagram of a server  
10 including an application module for generating worldwide names;

FIGURE 3A illustrates a block diagram of a MAC address;

FIGURE 3B illustrates a block diagram of a vendor  
15 specified identifier;

FIGURE 3C illustrates a block diagram of a worldwide name; and

FIGURE 4 illustrates a flow diagram for generating worldwide names.



DETAILED DESCRIPTION

Preferred embodiments and their advantages are best understood by reference to FIGURES 1 through 4, wherein like numbers are used to indicate like and corresponding parts.

FIGURE 1 illustrates a block diagram of a computer system 10 for generating worldwide names for associated component or targets 16. Network 18 interfaces with server 12 and initiator 14. In one embodiment, network 18 is a storage area network (SAN) that includes conventional networking components compatible with fibre channel protocol (FCP) and small computer system interface (SCSI) standards. The present disclosure is further applicable to networks compatible with additional protocols and standards. Typical SAN components are fibre channel based and may include host bus adapters, switches, bridges, disk arrays such as redundant arrays of independent disks (RAIDs) and other suitable components.

A SAN may be defined when physical storage device sharing is enabled, such as through fibre channel loops and hubs or switches. Each device interfaced with a fibre channel network may be referred to as a node. Nodes that generate and seek to store data, such as workstations or servers, may be known as initiators or originators. Nodes that act as data storage devices, such as disk storage, tape drives, or RAID devices, may be known as targets or responders. Alternatively, devices within a network may also be referred to as

originators, and devices that generate and seek to store data may be referred to as responders, especially within non-SCSI networks.

A SAN may use different types of topologies, including point-to-point, switched fabric, arbitrated loop and combinations of these topologies. In the point-to-point topology, nodes are connected by direct connections through a node port located in each of the devices. In the switched fabric topology, one or more electronic switching devices may be included that provide multiple, simultaneous, point-to-point connections between node pairs. In the arbitrated loop topology, devices may connect to the network via a loop port. A hub may be added to connect multiple nodes to one loop and allow devices to be added or removed from the loop with minimal disruption to the network.

FC technology allows data and network protocols to coexist on the same physical media. In one embodiment, the physical media may be a twisted pair copper cable used for the public switched telephone network (PSTN). In other embodiments, the physical media may be fiber-optic cable if the distance between nodes is too large for copper cable. A typical command set protocol is FCP-SCSI compatible for interfacing initiators, such as servers and work stations, with targets, such as conventional storage devices and RAID's. FCP-SCSI commands allow storage and retrieval of data to and from the initiator and the target storage device as though the

storage area network is simply an SCSI device interfaced through fibre channel fabric.

Server 12 interfaces with plural targets 16 and network 18. Targets 16 may be data storage devices, such as disk storage, tape drives, RAID devices, or other suitable devices. Targets 16 may couple to server 12 through a port, such as an initiator port, and may provide virtual storage for network 18. Although targets 16 are shown as being directly coupled to server 12, alternatively, targets 16 may be coupled to network 18 and indirectly coupled to server 12. Additionally, targets 16 have been shown to be coupled to server 12 via a single connection. However, the present disclosure contemplates the use of redundant connection between all components within system 10.

In operation, server 12 reads the media access control (MAC) address associated with network interface card (NIC) 18 and identifies targets 16. Server 12 then assigns each of targets 16 a unique vendor specified identifier and appends the vendor specified identifier on to the MAC address to generate a unique worldwide name for each of targets 16. Each identified target 16 is then assigned a unique WWN corresponding to its unique vendor specified identifier.

FIGURE 2 illustrates a block diagram of server 12. Server 12 includes NIC 18, application module 22 and initiator ports 24. NIC 18 couples server 12 to network 20 as shown in FIGURE 1. NIC may also couple server 12 to other networks, such as Internet Protocol (IP)

networks, Asynchronous Transfer Mode (ATM) networks, Frame Relay networks and other networks operable to communicate data.

NIC 18 includes a MAC address as shown in FIGURE 3A.

5 Application module 22 couple to NIC 18 such that application module 22 can read the MAC address of NIC 18. Application module 22 is further coupled to initiator ports 24A and 24B. Initiator ports 24A and 24B are coupled to targets 16A and 16B, respectively. In the

10 present embodiment, initiator ports 24A and 24B are directly coupled to target 16A and 16B. In an alternative embodiment targets 16A and 16B may be located remotely from initiator ports 24A and 24B . Application module 22 is preferably operable to identify targets 16

15 and initiator ports 24. In the present embodiment, initiator ports 24A and 24B and target 16A and 16B are provided. In an alternative embodiments a plurality of initiator ports 24 and targets 16 may be provided. The system may also facilitate the use of a selectable

20 configurable number of initiator ports 24 and targets 16 such that server 12 may have a selectable number of targets 16 based upon the functions and applications run on server 12.

Application module 22 may be a software component

25 stored within server 12. Alternatively, application module 22 may be a hardware component within server 12.

FIGURE 3A illustrates a block diagram of a MAC address. MAC address 30 includes company ID 34 and vendor specified ID 32. MAC address 30 contains 48 bits

- or 6 bytes of information. Bits 0-23 contain vendor specified ID; bits 24-47 contain company ID 34. Company ID 34 is preferably a company ID assigned to a particular manufacturer by the IEEE. Vendor specified ID 32
- 5 contains an identification code assigned by manufacturers. Each NIC 18 as shown in FIGURES 1 and 2 contains a MAC address 30.

- FIGURE 3B illustrates a block diagram of a vendor specified identifier 40. Vendor specified identifier 40
- 10 includes fibre channel device number field 42, a port field 44, a format field 46, the reserved field 48 and naming address authority (NAA) 50. Vendor specified identifier 40 contains two bytes or 16 bits of
- information. Bits 0-5 contain the fibre channel device
- 15 number 42; bit 6 contains port ID 44. Bit 7 contains format 46; bits 8-11 are reserved; and bits 12-16 contain ID name address authority field 50.

- FIGURE 3C illustrates a block diagram of worldwide name 60. Worldwide name 60 contains 64 bits of
- 20 information. Bits 0-23 contain vendor specified ID 32. Bits 24-47 contain company ID 34. Bits 48-59 contain vendor specified ID 52 as generated by application module 22 as shown in FIGURE 2 and bits 60-63 contain naming address authority field 50.

- 25 In operation, application module 22 reads MAC address 30 from NIC 18, including company ID 34 and vendor specified ID 32. Application module then generates the vendor specified information 40 as shown in 3B for a particular target 16. Application module 22

then appends MAC address 30 to include vendor specified identification 40 to MAC address 30 to generate worldwide name 60.

FIGURE 4 illustrates a flow diagram for generating  
5 worldwide names according to the present disclosure. In  
step 70, a MAC address is read from a NIC. In the second  
step an application module detects a fibre channel device  
or target associated with the NIC. If a fibre channel  
device is not found to be associated with the NIC, the  
10 process ends. If a fiber channel device is found to be  
associated with the NIC, then a vendor specified  
identification is generated for that fibre channel device  
in step 74. In the next step 76, the MAC address of the  
NIC is appended with the vendor specified ID generated in  
15 step 74. The application module then returns to step 72  
to identify any additional fibre channel device.

Although the disclosed embodiments have been  
described in detail, it should be understood that various  
changes, substitutions and alterations can be made to the  
20 embodiments without departing from their spirit and  
scope.